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(54) Connector coupling for optical waveguides

(57) A connector coupling comprises two identical screwable connector halves (1); the plug holes are covered by a protective rotary disc (25). This disc is connected to a piston (27) and is supported between a coverplate (24) and the piston (27).

The rotary disc (25) prevents the piston member (27) which is accommodated for axial movement in the connector housing (2) from moving until the coverplate (24) is displaced by relative movement of the connector halves (1). The plug holes are opened as the connector housings (2) are brought together, when the piston members move together and the fibre end sleeves are guided in the through-bores of the piston members.

The connector halves which are in engagement with one another, are screwed together by nuts.

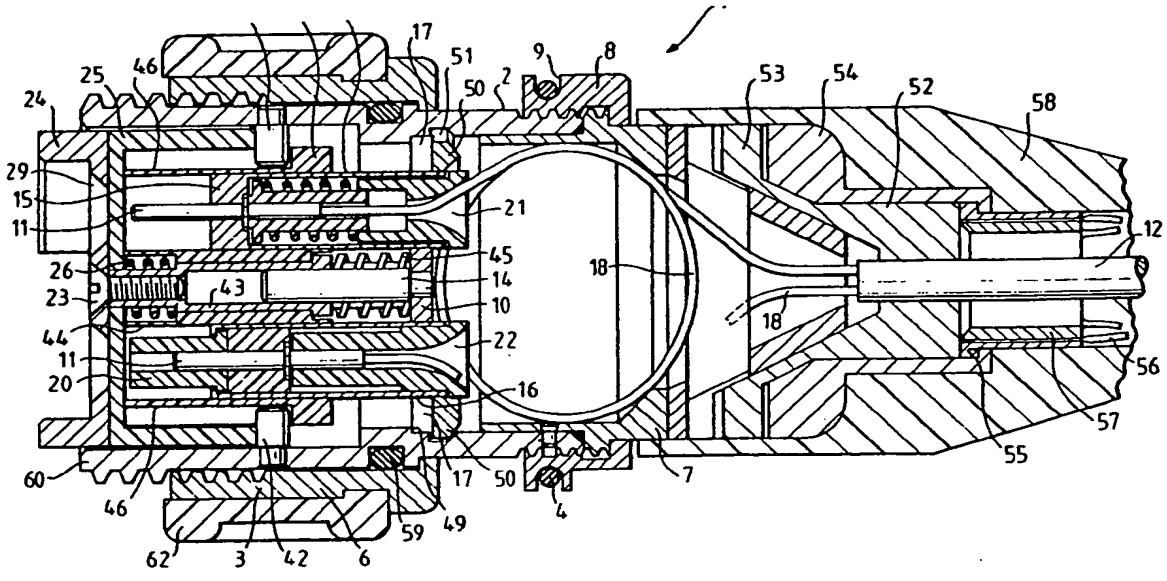

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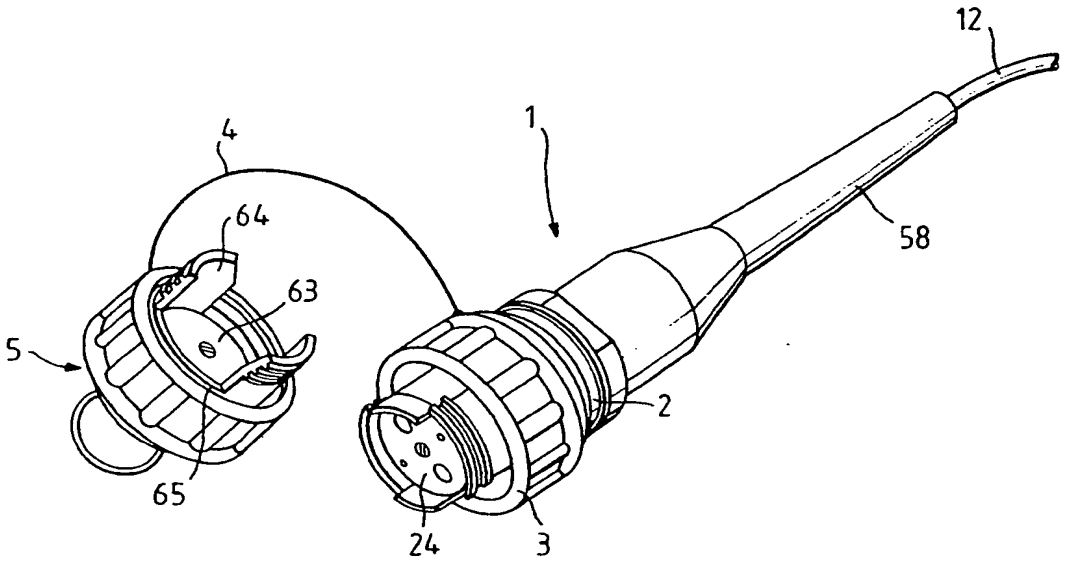
Fig. 1.



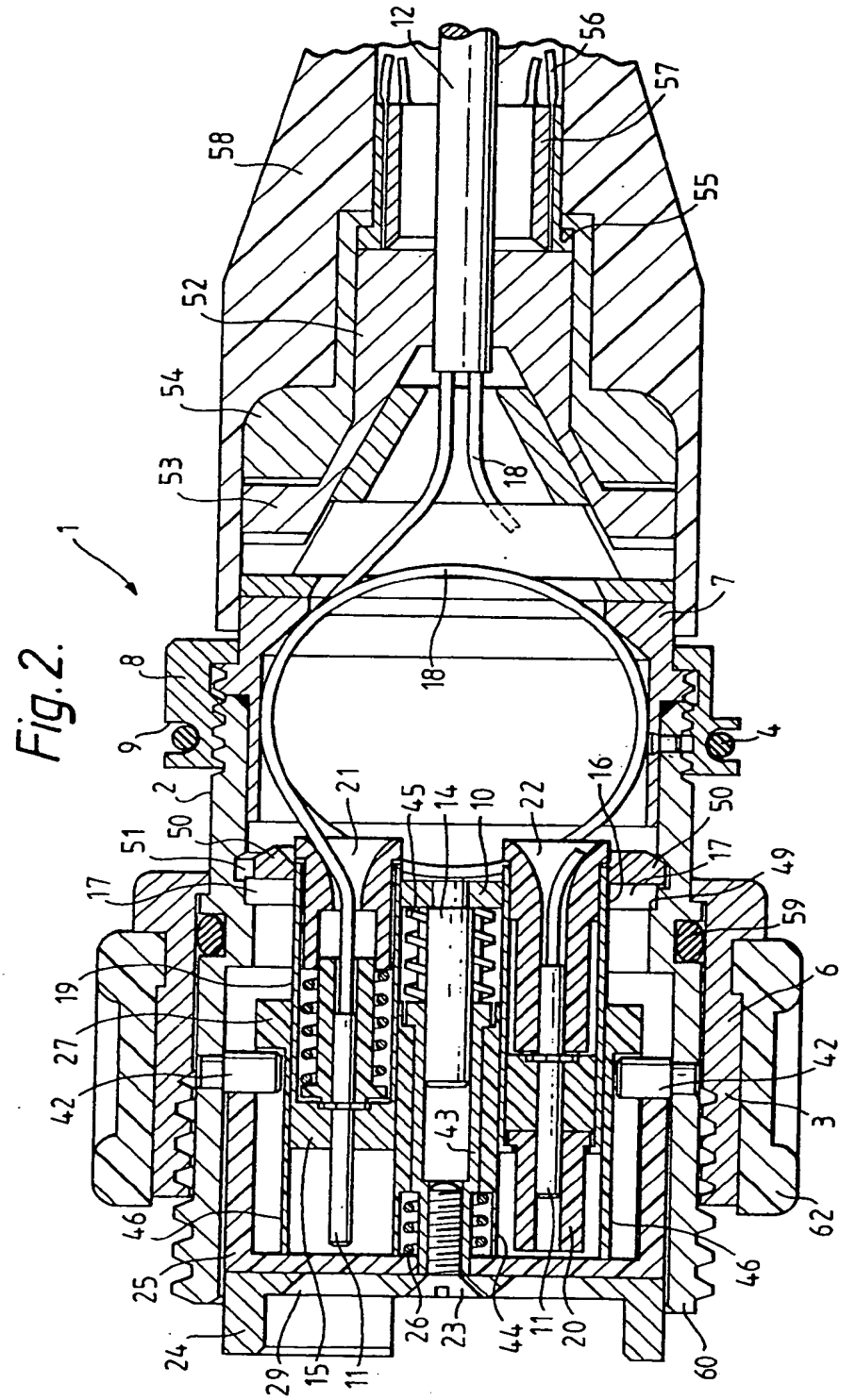


Fig.2.

Fig.3.

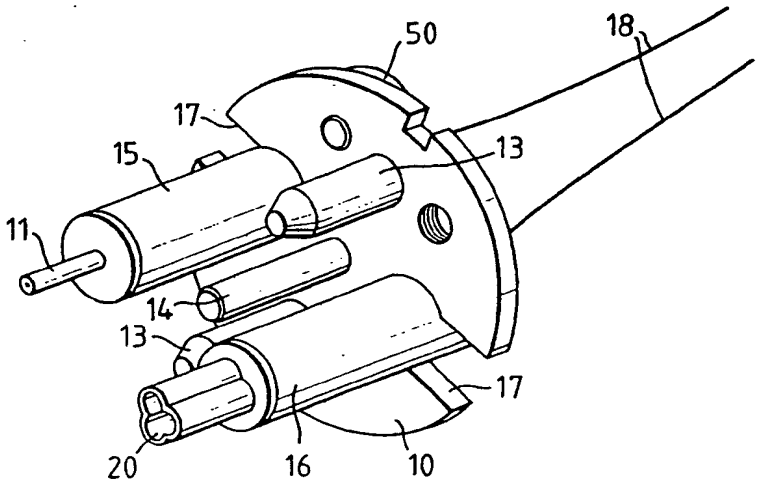
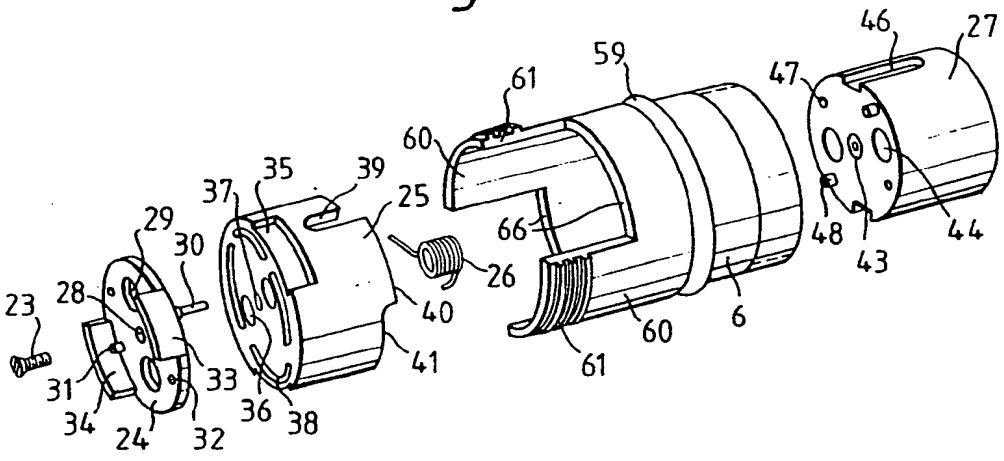


Fig.4.



SPECIFICATION

Connector coupling for optical waveguides

This invention relates to a connector coupling for optical waveguides which consists of two identical screwable connector halves.

Connector couplings of the aforementioned type are generally employed for coupling fibre optic cables used in optical communications systems in which, at the beginning of the first line section of a transmission link, there is arranged an optical signal source, and in which the end of this line section is to be coupled to the beginning of a second line section at the end of which there is arranged an optical signal receiver or else a connector coupling with a further line section.

A connector coupling which is known to us comprises two identical screwable connector halves of which each one contains at least two fibre end sleeves which, in the disconnected state of the connector coupling, are on their end faces protected against the penetration of foreign matter and, when joining the halves of the connector coupling, are capable of being coupled to one another by the actuation of rotatable parts.

This type of connector coupling comprises on its end face a projecting, semicylindrical shell which, during the coupling of two connector halves, serves as a coding for ensuring connection to the proper terminals. The rotary parts each consist of an outer protective sleeve with a bayonet catch which, when joining the connector coupling halves, are mutually tightened with respect to one another. The interior of the connector halves are protected against the penetration of foreign matter by a glass plate arranged in front of the optical fibre ends inside the connector housing.

The present invention seeks to provide a sturdy connector coupling suitable for employment under difficult conditions in the field, in the course of which the coupling may be subjected to high mechanical stresses. According to the invention there is provided a connector coupling for optical waveguides, which comprises two identical screwable connector halves of which each one contains at least two fibre end sleeves which, in the disconnected state of the connector coupling, are on their end faces protected against the penetration of foreign matter and, when joining the halves of the connector coupling, are capable of being coupled to one another by the actuation of rotatable parts, characterised in that between a coverplate forming the end face of each connector half and a piston member firmly connected to said coverplate and capable of being displac d in the axial direction inside the connector housing, there is arranged a rotary disc blocking the axial movement of said piston member, with the blocking function thereof capabl of being eliminated by turning the connecter halves which are in preliminary ngagement, in pposite directions, so that said piston members in the course of the further joining of said connector halves, give way inside said housing, thus permitting the fibre end sleeves to project through corresponding openings in both said coverplate and said rotary disc tobe applied to each other with their end faces.

The invention results in the covered plug openings of the connector halves being automatically opened during the joining of the halves of the connector coupling, thus permitting a direct, mutual application of the fibre end sleeves to each other. The rotary disc which is used in this connection, is protectively supported behind the coverplate which is of a mechanically stable design. Moreover, the coverplate has a mechanically firm connection with the piston part as arranged behind the rotary disc when looked at from the end face of the connector half, with this piston part, in turn, being accommodated with a sturdy sliding guide inside the connector housing. Therefore, the fibre end sleeves which are inserted in receptacle sleeves, which, in turn, are guided in the piston part, are protected in particular against shock and vibrational influences. Further advantages can be seen from the specification.

In order that the invention and its various other preferred features may be understood more easily, an embodiment thereof will now be described, by way of example only with reference to the drawings, in which:

Figure 1 shows one connector half with an unscrewed protective cap, in a perspective representation,

Figure 2 shows the connector half as shown in Fig. 1, with its protective cap, in a sectional elevation,

Figure 3 shows one baseplate of the connector housing with the mounted coupling elements of the optical waveguides as well as one centering and two supporting bolts for guiding the moveable functional parts, in a perspective representation, and

Figure 4 is an exploded perspective view of the front part of the connector housing showing the assembly of the coverplate, the rotary disc, the torsion spring, and one piston part.

In the drawings Figs. 1 and 2 show a connector half generally indicated by the reference numeral 1, of which two identical types are capable of being joined to form a connector coupling. The housing 2 thereof is provided with a screw collar nut 3 serving to mutually screw two connector halves 1 to one another. Moreover, the housing 2 is surrounded by a connecting link 4 to which a protective cap 5 is attached. In the uncoupled stat of the connector coupling the end faces of the connector halves are closed by screwing ther on th respective protective cap.

As can be seen from Fig. 2, the housing 2 consists of front and rear portions 6, 7 which are screwed to one another with the aid of an annular nut 8. The latter is appropriately provided with a circumferential groove 9 in which the connecting rope 4 is undetachably retained. While the front portion 6 of the housing contains guide members arranged on a baseplate 10, for guiding fibre end sleeves 11 as well as devices serving for protection against contact and for coupling the fibre end sleeves 11 in the proper positions, the rearward portion 7 of the housing comprises means for sealing, strain relief and a protective anti-kink device for fibre optic cable 12.

On the baseplate 10 of the front portion 6 of the housing 2, as can be seen in particular from Fig. 3, there are arranged two supporting bolts 13, a centering pin 14 projecting from the centre thereof and, at a right angle in relation thereto, two receptacle sleeves 15, 16. While the supporting bolts 13 and the centering pin 14 are firmly connected to the baseplate 10, the receptacle sleeves 15, 16 are floatingly supported in diametrically arranged slots 17 in the baseplate 10. In each of the two receptacle sleeves 15, 16, there is inserted one fibre end sleeve 11 in which there is respectively fixed the stripped end of an optical fibre 18. One fibre end sleeve projects out of the receptacle sleeve 15 in which it is axially and resiliently supported with the aid of a compression spring 19. Inside the other receptacle sleeve 16 the second fibre end sleeve is firmly mounted, in such a way that its front end projects into a guide bush 20 which, in turn, projects out of the receptacle sleeve 16 and, when mated, centeringly takes up the resilient fibre end sleeve of the opposite connector half. The rearwardly open ends of the receptacle sleeves 15, 16, in accordance with the fibre end sleeve arrangement, are closed by different length distance pieces 21, 22 which are mounted by pressing therein and which are rearwardly provided with funnel-shaped entrances for the optical fibres 18.

Fig. 2 shows further component parts of the connector half 1 arranged inside the front portion 6 of the housing 2, and which are all joined to one another with the aid of only one single mounting screw 23 or a corresponding rivet, to form one functional subassembly group. In particular, these parts include a coverplate 24 which is preferably made of metal, a rotary disc 25 which is made of plastics material, and a piston member 27 which is to be provided with a torsion spring 26, with the piston member 27 similarly being made from a plastics material. The coverplate 24 is provided with a centrically arranged countersunk bore 28 for the mounting screw 23 as well as with two bores 29 which may likewise be countersunk, for permitting the passage of the optical contacts. Moreover, the coverplate 24 carries on its rearside two centering pins 30 whose rearward ends 31 project in the form of short studs on the front side of the coverplate 24. For engaging the centering-pin ends of the opposite connector half, the coverplate 24 is provided with two corresponding centering boreholes 31. Finally, on the front side of the coverplate there are also provided two extensions 33, 34 of different arch lengths preferably projecting in a collar-shaped manner on the rim portion which, on the one hand, permit a definite positioning of two connector halves in relation to one another and also act as a fixed coding but, on the other hand, during the coupling process, also serve as means for engaging the rotary disc of the opposite connector half.

The rotary disc 25 is of pot-shaped design and is provided along its circumference, on the side facing the coverplate 24, with recesses 35 corresponding to the arch-shaped extensions 33, 34 of the coverplate 24 of the opposite connector half, and, during the coupling process, the extensions and recesses are brought into mutual engagement. Moreover, it contains openings 36 corresponding to the bores 29 in the coverplate 24, as well as a centric bearing hole 37 and four arcuate slots which are disposed near the circmference and are equally spaced. Two further slots 39 staggered in relation to one another by 180°, are arraged at the end of a recess 41 respectively shortening the rear edge 40, in such a way as to extend in the axial direction. Therefore, the rotary disc 25 can be guided during the coupling process in the course of the movements by way of guide pins 42 (Fig. 2) provided on the inside wall of the front portion 6 of the housing 2, with this permitting at first a rotary movement and, directly thereafter, a longitudinal movement of the two connector halves.

The piston member 27 contains a centric bore with a guide sleeve 43 pressed therein, and two through bores 44 for guiding the receptacle sleeves 15, 16 containing the fibre end sleeves 11. Moreover, on the rear side, there are provided two blind holes in each of which there is inserted a compression spring 45 (Fig. 2) which is tensioned during the coupling process and, during the uncoupling, returns the piston member 27 to its (not shown) initial position. Moreover, Fig. 4 shows two grooves 46 extending in the axial direction, which are open at their front ends and by which, in conjunction with the previously mentioned guide pins 42 on the inside wall of the housing 2, both the direction of movement and the length of travel of the piston member 27 are defined. The front side of the piston member 27 also comprises two bores 47 which are of the same diameter as the centering pins provided on the coverplate 24, as well as two spacing pins 48. The

latter, subsequently to the assembly of the parts permit the rotary disc 25 to be capable of moving.

It can be seen from Fig. 4 that the piston member 27, when being assembled, is introduced from the rear side to such an extent into the front portion 6 of the housing 2, that the ends of the two piston grooves 46 inside the housing abut the guide pins 42. After this, the torsion spring 26 which is designed as a leg spring, is located on the guide sleeve 43 in a recess in the piston member 27, and, with a pretension, is hooked into the rotary disc 25 as it is inserted from the front over the piston member 27. The spacing pins 48 of the piston member 27 engage in two corresponding slots 38 of the rotary disc 25. After that, the coverplate 24 with its centering pins 30 is inserted through the other two slots 38 of the rotary disc 25, into the bores 47 of the piston member 27 specially provided therefor, and the arrangement is interconnected with the aid of the mounting screw 23 screwed into an internal thread provided for in the guide sleeve 43 of the piston member 27.

In this position, the coverplate 24 is antirotationally secured to the piston member 27, in such a way that the bores 29 serving the passage of the optical fibre sleeves of the opposite connector half, are in alignment with the through-going bores 44 provided in the piston member 27. The rotary disc 25 as arranged between the coverplate 24 and the piston member 27 remains rotatable within defined limits. The openings 36 thereof serving the passage of the optical fibre sleeves are staggered in the normal position of the rotary disc, with respect to those in the coverplate 24 and the piston member 27. The arrangement of the slots 38 in the rotary disc 25, in connection with the spacing pins 48 in the piston member 27 and/or the centering pins 30 of the coverplate 42, restrict the angle of rotation for the flush alignment of their openings 36 with the corresponding bores 29, 44 to preferably 60°.

In a simplified example of embodiment of a connector half, not shown in the drawings, the use of a special coverplate is obviated. The rotary disc is in this case provided with through bores which, in the uncoupled position, are closed and, at the end of the rotary movement of the coupling process are open for permitting the passage of the optical fibre sleeves. Of course, this rotary disc is provided on its end face with depressions and elevations which, at the beginning of the coupling process, permit a defined positioning of the two connector halves in relation to one another and which, when brought into mutual engagement, effect a corresponding centering.

In the course of the further assembly of the connector half 1, the baseplace 10 previously assembled as already described hereinbefore, is inserted from behind into the piston member 27, to such an extent until meeting against an inside shoulder 49 of the portion 6 of the housing 2 (Fig. 2). In so doing, the centering pin 14 enters into the rearward portion of the guide sleeve 43, and the receptacle sleeves 15, 16 and the supporting bolts 13 enter into the corresponding bores of the piston member 27. By means of several eccenter discs 50 provided for on the rearside of the baseplate 10 within the marginal area, which project into a corresponding groove 51 of the portion 6 of the housing 2 and are screwed to the baseplate 10, the arrangement is mechanically fixed in position inside the housing. Thereafter, the front portion may be screwed to the rear portion 7 of the housing. This rear portion 7 of the housing 2 contains a sealing bushing 52 tightly surrounding the introduced fibre optic cable 12, with the flange 53 thereof, together with a strain-relief member 54 being screwed to the portion 7 of the housing 2. Between the end of the sealing bushing 52 and an internal shoulder 55 positioned at the end of the strain-relief member 54 there is moreover supported a flange sleeve 57 crimped to a cable grip 56. Finally, the entire arrangement is covered with a rubber-elastic protective sleeve 58 pulled thereover.

For the rearward sealing of coupled connector halves there is also provided on O-ring 59 seated on the front portion 6 of the housing 2. As can be seen in particular from Fig. 4, the front portion 6 of the housing comprises two coupling claws 60 which are provided at their front ends wit an external thread 61 and serve the mutual screwing of the coupling claws 60 of two connector halves engaging into one another. The screwing is effected with the aid of screw collar nuts 3, with the screw collar nut of the one connector half being respectively screwed onto the thread 61 of the coupling claws 60 of the other connector half. Owing to the fact that the screw collar nuts 3 are provided with a protective rubber ring 62 projecting on the front side, the seam between two screw collar nuts 3 screwed against each other firmly, is automatically sealed.

In Fig. 1 the protective cap 5 belonging to each of the connector halves 1, is shown to be lying next to the connector half. This cap consists substantially of two pot-shaped parts arranged one inside the other and rotatably connected to each other, of which the inner part 63 comprises on its end face coupling claws 64 substantially corresponding to the shape of the front portion of the housing 2, while the outer part 65 is designed as a screw collar nut closed at one end and carrying a protective rubber ring, serving the sealing function on the end face. The protective cap 5 contains a locking member which, in the detached, hence the unscrewed state, locks both the inner and the outer part 63, 65

against being further turned, with the locking effect thereof, however, being eliminated during the screwing process, thus permitting a rotary movement of the two parts 63, 65 in relation to one another.

The coupling of two connector halves is accomplished in such a way that first of all the protective cap 5 of each connector half, which is always fitted when the connector half is not in use, is unscrewed and the screw collar nut 3 is loosened. Since the connector halves 1 are provided on their jacketing surfaces with a noticeable marking which, for example, may consist of a thumb cam arranged on the protective rubber sleeve 58, they can be brought in such a way into alignment with one another, that the extensions 33, 34 of the cover plates 24 each engage into the complementary recesses 35 of the rotary discs 25. By turning the connector half 1 by 60° in the anticlockwise direction, the plug holes of the connector halves are brought into alignment with the corresponding openings 36 of the rotary discs 25, with the ends 31 of the centering pins 30 at the cover plates 25 simultaneously engaging into the complementary centering bores 32. In this position also the coupling claws 60 are opposite their corresponding recesses 66, so that the connector halves may now be pushed against each other, with the two screw collar nuts 3 being tightened optionally either simultaneously or one after the other.

When pushing together the connector halves, the piston members 27 and the functional members connected thereto, give way, thus causing the compression springs 45 seated on the supporting bolts 13 of the baseplates 10, to be more strongly tensioned. At the same time, the movably supported fibre end sleeves 11 enter into the complementary guide bushes 20 and are resiliently pressed against the end faces of the fibre end sleeves firmly arranged inside the guide bushings or the receptacle sleeves 16. After the connector halves have been coupled, the separate protective caps are placed one into the other and tightly screwed into one another.

The uncoupling of the connector halves is effected in the opposite order of sequence. Following the unscrewing of the screw collar nuts, and when separating the connector halves, the plug-in openings are automatically closed in that the rotary discs 25, under the action of their torsion springs 26 which are more strongly tensioned during the coupling, are allowed to return to their normal positions. In this way, the interior of the connector half 1 which is not yet covered on its end-face side, is protected against contact and soiling. While the connector halves can only be joined togeth r in a defined position, the protective caps can be positioned or mutually screwed to one another in two angular positions.

CLAIMS

1. A connector coupling for optical waveguides, which comprises two identical screwable connector halves of which each one contains at least two fibre end sleeves which, in the disconnected state of the connector coupling, are on their end faces protected against the penetration of foreign matter and, when joining the halves of the connector coupling, are capable of being coupled to one another by the actuation of rotatable parts, characterised in that between a coverplate (24) forming the end face of each connector half (1) and a piston member (27) firmly connected to said coverplate (24) and capable of being displaced in the axial direction inside the connector housing (2), there is arranged a rotary disc (25) blocking the axial movement of said piston member (27), with the blocking function thereof capable of being eliminated by turning the connector halves (1) which are in preliminary engagement, in opposite directions, so that said piston members (27), in the course of the further joining of said connector halves (1), give way inside said housing (2), thus permitting the fibre end sleeves (11) to project through corresponding openings (29, 26) in both said coverplate (24) and said rotary disc (25) to be applied to each other with their end faces.

2. A connector coupling as claimed in claim 1, characterised in that said housing (2) of each of said connector halves (1) is provided at its front with two coupling claws (60) which are separated from one another by step-shaped recesses (66), with said coupling claws (60), upon pushing back of said piston member (27), each engaging into the recesses of the opposite connector half and, in this position, are fixed with the aid of a screw collar nut (3) which is seated on each of said housings (2), in such a way that the screw collar nut (3) of the one connector half (1) is respectively screwed on the coupling claws (60) provided with an external thread (61), of said other connector half.

3. A connector coupling as claimed in claim 1 or 2, characterised in that said piston member (27) of said connector half (1) comprises a centrically arranged guide sleeve (43) for mounting said coverplate (24), two through bores (44) for guiding receptacle sleeves (15, 16) each provided with a fibre end sleeve (11), as well as two blind holes arranged on the rear side, which each take up a compression spring (45) which are tensioned during the coupling process, and, during the decoupling process, return said piston member (27) into its initial position.

4. A connector coupling as claimed in claim 3, characterised in that on the end of said guide sl eve (43) as projecting forwardly out of said piston member (27), there is supported said rotary disc (25) which, via a pretensioned torsion spring (26), is connected

to said piston member (27).

5. A connector coupling as claimed in any one of claims 1 to 4, characterised in that said piston member (27) of the connector half (1) is provided along its circumference with several grooves (46) which extend in the axial direction, with said grooves (46) being engageable by guide pins (42) which project on the inside of said housing (2).

6. A connector coupling as claimed in claim 5, characterised in that the rotary disc (25) is pot shaped and is provided at its rearward rim portion with slots (39) and recesses (41) for controlling the axial movement of said piston member (27) with the aid of said guide pins (42) as mounted inside said connector housing (2).

7. A connector coupling as claimed in any one of claims 1 to 6, characterised in that said rotary disc (25) contains four arcuate slots (38) into two of which extend two spacing pins (48) which project from said piston member (27), the other two of which arcuate slots are traversed by two centering pins (30) mounted on said coverplate (24) which, in turn, engage into corresponding bores (47) of said piston member (27).

8. A connector coupling as claimed in any one of claims 1 to 7, characterised in that said slots (38) of said rotary disc (25) and said spacing pins (48) of said piston member (27) form a limitation of the angle of rotation.

9. A connector coupling as claimed in any one of claims 1 to 8, characterised in that the limitation of the angle of rotation of said rotary disc (25) includes an angle of 60°.

10. A connector coupling as claimed in any one of claims 1 to 9, characterised in that said coverplate (24) of said connector half (1) is provided on the coupling side with collar-shaped attachments (31, 33) of different arcuate length and which, when joining the connector coupling, each engage into complementary recesses (35) provided in said rotary disc (25).

11. A connector coupling as claimed in claim 7 or any one of claims 8 to 10, when dependant from claim 7 characterised in that the ends (31) of said centering pins (30) project on the front side of said coverplate, and when joining the connector coupling, engage at the end of the rotary movement, mutually into corresponding centering bores (32) provided for in said coverplate (24).

12. A connector coupling as claimed in any one of claims 1 to 11, characterised in that said coverplate (24) and said rotary disc (25) are combined to form one single function element.

13. A connector coupling as claimed in any one of claims 1 to 12, characterised in that said piston member (27) is supported by a guide sleeve (43) on a centering pin (14) of a baseplate (10) mounted inside said connector housing (2).

14. A connector coupling as claimed in claim 13, characterised in that said baseplate (10) is provided with two supporting bolts (13) for guiding compression springs (45) inserted in said piston member (27), and with two slots (17) for the radially floating support of receptacle sleeves (15, 16) which are provided with said fibre end sleeves (11).

15. A connector coupling as claimed in claim 13 or 14, characterised in that said baseplate (10) is mounted in position by being applied to an inside shoulder (49) of said connector housing, as well as by eccenter discs (50) which project into a groove (51) of said housing (2) and which are screwed to said baseplate (10).

16. A connector coupling as claimed in any one of claims 1 to 15, characterised in that one of said fibre end sleeves (11) freely projects with its front portion out of a receptacle sleeve (15), in which it is supported in an axially resilient manner, while another receptacle sleeve (16) contains a projecting guide bush (20) with a firmly mounted fibre end sleeve (11), and which, during the coupling process each time receives the front portion of the resilient fibre end sleeve of the opposite connector half.

17. A connector coupling as claimed in any one of claims 1 to 16, characterised in that said connector half (1) comprises a front housing member (6) containing the parts necessary for the coupling process and of a rear housing member (7) mounted thereto with the aid of an annular nut (8), with said rear housing member (7) comprising the parts which are required for connecting a fibre-optic cable (12).

18. A connector coupling as claimed in any one of the preceding claims characterised in that a protective cover or cap (5) comprises two pot-shaped parts which are arranged one inside the other and which are rotatably interconnected, in which the inner part (63) is provided on its end face with coupling claws (64) having a shape substantially corresponding to the shape of the front part of the housing, and of which the outer part (65) is designed to have the shape of a screw collar nut closed at one end.

19. A connector coupling as claimed in claim 18 characterised in that said protective cover or cap (5) comprises means for locking the inner and the outer parts (63, 65) thereof in the unscrewed state, against being further rotated, and that said locking is automatically eliminated during the screwing process.

20. A connector coupling as claimed in claim 18 or 19, characterised in that said screw collar nut (3) of said connector half (1) and a or the protectiv cover (5) thereof are each provided with a prot cting ring of rubber (62) projecting on the nd faces.

21. A connector coupling for optical wave-guid s substantially as described her in with

ref r nce to the drawings.

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